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This latter mineral is pleochroic in blue and green tints, while the former is pleochroic in brown and brownish red tints. Barkevikite is an essential constituent of the augite syenite occurring between the fjords of Christiania and Langesund.——*Spangolite* is proposed by Penfield[3] as the name for a hydrated sulphate and chloride of copper, occurring, probably, somewhere in the Globe District, Arizona. The new mineral incrusts cuprite, and is associated with azurite and atacamite (?). It is rhombohedral, with its crystals bounded by oP and a series of pyramids of the second order. The cleavage is perfect parallel to oP. Etched figures produced on the basal plane by the use of dilute acids are bounded by oP and scalenohedral faces. They are all very clear, and all have an undoubted rhombohedral symmetry. By reflected light the mineral is dark green, while by transmitted light it is light green. Pleochroism is slight. The double refraction is strong and negative, with $\alpha=1.694$, $\varepsilon=1.641$. Hardness on oP is 2, and on the pyramidal faces 3. Specific gravity is 3.141. The average of four analyses gives:

| $SO_3$ | Cl | $Al_2O_3$ | CuO | $H_2O$ |
|---|---|---|---|---|
| 10.11 | 4.11 | 6.60 | 59.51 | 20.41 |

corresponding to $Cu_6AlClSO_4+9H_2O$.

## BOTANY.

**Some Reasons for Varieties not soon Wearing Out.**—The direct result of a union of two or more distinct protoplasmic masses, in plant life, is a condensed, inactive, and transportable condition of the life of the species, that is, a seed or spore. Among lower plants this reproductive union usually takes place in the simplest manner, and at times that are determined by unfavorable circumstances for a further continuance of the life of the species in its ordinary rapidly-growing condition. Thus the moulds form their resting spores when the prospects are that resting spores will be most needed to carry the life of the species over the approaching period of cold, drought, or lack of food supply. The uniformity of the coming and going of the seasons has its parallel in the uniformity with which the higher plants produce their annual crop of seeds. In the great struggle for life that is going on, it is perhaps true that some species have found it to their advantage to form their seed early, and long before the time when the season of approaching winter should suggest it. It may be that such species have learned by sad experience that with them it is early seeding or none at all.

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[3] *Amer. Jour. Science*, May, 1890, p. 370.

In the lowest forms of life there is not even the union of protoplasm for the formation of the inactive state. The resting spores of the Bacteria are, as far as we know, ordinary cells, the protoplasm of which is unusually protected by a thick cell wall. As we rise in the scale of plant life, the points of origin of the two protoplasmic elements become more widely separated. In the pond scums (Spirogyra) it may be that the contents of adjoining cells unite to form the zygospore. Among flowering plants this question brings in review the subject of sexual separation, as worked out in the various lines of dimorphism, dichogamy, etc., until we arrive at the diœcious plants. From the bacterium resting spores, formed out of the contents of a single cell, the two lines diverge until we find their opposite extremities separated by diœcism; a condition in which for the formation of an offspring, corresponding functionally with the primordial spore, there must be the union of a particle of protoplasm of one community of individuals (tree or herb) with another of a separate and otherwise independent community.

Another parallelism of differentiation may be seen. Among the lower forms of life there is but little variation among the units; the one reflects the other, and species are founded upon differences that are only determined by using the micrometer. The higher types show not only a greater variation in the units, but the communities made up of these have their distinct peculiarities. One white pine or maple is not like all others of its kind.

It may, perhaps, be stated as a rule that where there is the greatest separation of the sexes, within the limits of the law, there is the greatest variation, or the extreme tendency to vary. If the union is between different species, there are new lines of variability bestowed upon the offspring. If this hybrid unites with another distinct hybrid, it is easy to see that the current of tendencies is again made doubly complex, and if the offspring is able to bear the load that the law of heredity throws upon it (now a broken law), the result will be a set of plants almost as easily turned in their course as autumn leaves floating on a sluggish stream.

Reproduction by union is a deeply laid plan among the higher orders of plants. Many plants during one year prepare for its occurrence in the next. Pollen to be shed in the spring is prepared the previous autumn, and the female germ cells are also already made to receive the quickening dust. If we may judge of importance by complication of structure, the process of bringing distant particles of protoplasm together seems the leading end of many plants. If seeds fail the plant has failed. Perennial plants, and those that are easily propagated non-sexually, are less subject to the law of "union or death" that prevails among annuals and biennials.

Reproduction by union among the lower forms of life is primarily to place the species out of the jeopardy that otherwise might follow untoward circumstances, and also to facilitate its more thorough distribution. When we arrive as high in the scale as the ferns we find that the union takes place once for all in the life of the fern plant, and that the direct and immediate result is not a spore, but a plant upon which the spores are afterwards borne annually in great numbers without further fertilization. Each spore in germination produces a small, delicate scale of cells, the prothallus: one protoplasmic mass, the germ-cell of the archegonium, grows into a fern plant after it has been stimulated by the commingling with it of the male elements. Cases are on record where the fern plant has developed from the prothallus without the intervention of the antherozoids, but they are rare. A few plants may go on for many years producing crops of spores, but it is the rule that it shall not begin this life of spore-bearing until a union has taken place. In the moss the union precedes the formation of each capsule, and each capsule bears a multitude of spores. For the same number of spores it is easy to see that fewer unions are required in the moss than in the pond scum, and more than in the fern. Although this union enters into the plan of reproduction, its influence is far-reaching. Only the mathematician can write the figures representing the number of spores produced by a tropical tree fern through its long existence.

The moulds and low-water plants may rejuvenate by union upon seemingly the slightest provocation. In the moss it means much more than in the lower forms, and in the ferns it means infinitely more. As we pass beyond the cryptogams, and study the flowering plants, may it not be safe to conclude that here, where the structures in the sexual apparatus are vastly more complicated than upon the prothallus, we have results that are correspondingly more lasting? It suffices for the banyan-tree, that covers many acres, and the impulse of fertilization lasts through the lifetime of the oldest trees, which is estimated to be not less than four thousand years. Every seed that falls from the giant red-wood has its spore in the vitality stimulated by the original union. If this be not true, then we are forced to believe that the union was only serviceable, like the starch and oil in the cotyledons, for the initial growth of the seedling. Whatever view we take, the assumption holds that a union among flowering plants is more significant than with the ferns and allied cryptogams. If this assumption seems reasonable, it is not unsafe to conclude that it is not easy to limit the time that the offspring of any union may exist.

On the same basis it may be asserted that the wider the union the more vigorous the progeny, and the more certain it will be to succeed. This statement rests on a broad basis of fact. Darwin's work on "Cross and Self Fertilization in the Vegetable Kingdom" is a corroboration of the statement, that "Nature abhors continual close fertilization." If the rule be reasonable among weed plants, it will appear even more so among domestic vegetation, in so far as wideness of fertilization is concerned. Nature has but comparatively few varieties. They may take the initial step, but be crowded out, the struggle being oftentimes too fierce. Among cultivated plants the conditions are very different. The plants are removed from the intense action of the law which determines the "survival of the fittest." The weeds are the best fitted to survive, but the hoe befriends the weaker and better (for man) species. Cultivated plants, therefore, lead a life of comparative peace, and their energies are expended along the lines that the cultivator desires to follow. Variations appear, and are carefully watched and propagated, and in time a new sort is established. The conditions are vastly more variable under which cultivated plants exist than those of their wild allies. This leads to a wide range of characteristics even in the same variety. Unions, therefore, are here more powerful, under the rule that wild is more potent than close fertilization. Each individual is the balance-sheet of a long series of forces, both of within and without.

The two controlling laws of life, which for brevity's sake may be stated as: Like produces like, and, like produces unlike, doubtless act everywhere. But the first prevails in the lower forms of plants while the second dominates over the higher. As an extreme instance note the human race with its millions of individuals, no two of which are unmistakably alike. Even here the greatest variations are in the more highly developed classes or nationalities. The type of gentleman is more variable than the type of the Hottentot. The dominant motive of the former is not so constant and all-absorbing as in the latter.

The wild plant exerts all its powers to keep even with its rivals. The cultivated plant has thrown down its arms, and is active in building those structures that are useful to man. To rear young through seed may be lost from sight in part when man is satsified that the labor shall be along other lines. Man becomes the responsible party, and only the refractory and therefore worthless species will not acknowledge him as master when he treats them like King.

There is therefore a strong argument in favor of the view that cultivated varieties should remain intact indefinitely if conditions for growth remain constantly favorable.—BYRON D. HALSTED, *Rutgers College.*

**The Causes of Cypress Knees.**—From the teleological standpoint the the buttress function of the cypress knees was ably advanced in the last number of the AMERICAN NATURALIST, and while reading the article it occurred to me that the swaying of the trunk by winds would unavoidably produce a pulling strain upon roots at any angle with the tree, with a tendency to the elongation of such roots, particularly the outermost ones, and with the rebound or push of the tree in the opposite direction there would occur angularities at the points of greatest stress, in such outer roots, with sap exudation at such angles, and the piling up of indurated tissue in such forms as we find in the "knees." Recollecting that Herbert Spencer had dealt with plant morphology in a general way, I looked up the reference, and believe that his Chapter II., Part V., Vol. II., Principles of Biology, covers the subject admirably, especially in the words of Sec. 279: "Many commonplace facts indicate that the mechanical strains to which upright gravity plants are exposed, themselves cause increase of the dense deposits by which such plants are enabled to resist such strains."—S. V. CLEVENGER, *Chicago.*

## ZOOLOGY.

**Phymosoma.**—A. E. Shipley has recently published his complete paper[1] on the anatomy of the West Indian gephyrean *Phymosoma varians.* Above the mouth is the horseshoe-shaped lophophore, which bears a varying number (but always even) of tentacles; below is the vascular lower lip. Both lip and lophophore have a skeleton which gives attachment to the retractor muscles. The nervous system consists of a bilobed brain connected with the ectoderm within the lophophore. This gives rise to three pairs of nerves, one supplying the pigmented tissue of the region in front of the mouth, the second sending branches to the tentacles, while the third, sending a branch on either side of the œsophagus, unites below in the ventral nerve cord, which shows no traces of double origin, and which is not ganglionated. From it arises at intervals a single median nerve, which later divides

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[1] *Quarterly Jour. Micros Sci.*, XXXI., p. 1, Apr., 1890.